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MANAGEMENT OF MUCK-LAND FARMS IN NORTHERN INDIANA AND SOUTHERN MICHIGAN.

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CONTENTS.

INTRODUCTION.

In Indiana and Michigan there are approximately 3,750,000 acres of swamp land, largely muck. In northern Indiana and southern Michigan much of this land has been improved and is at present producing large quantities of grain, truck crops, and peppermint and spearmint oil. In many places the land has been farmed for from 10 to 25 years, and very definite types of farming have been developed. In fact, this section contains the largest area of improved muck land to be found in the North Central States. For this reason the investigations reported in the following pages were carried on in this region.

In this work the writer visited 140 muck-land farms. On 100 of these farms a detailed analysis of a year's business was obtained for the farm year beginning March 1, 1914, and ending March 1, 1915. This analysis consisted of a valuation of all farm property, including the amount of capital invested in land, buildings, live stock, machinery,

NOTE.—This bulletin should be of interest to muck-land farmers of northern Indiana and southern Michigan and also to farmers in other sections of the country where soil and climatic conditions are similar or comparable.

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supplies, and cash for current expenses, and an inquiry into the sources and amount of receipts, the nature and amount of expenses, the rate of depreciation on buildings and machinery, and other items bearing on the profits of the farm.

From practically all of the 140 farms information was obtained on the methods of draining muck land, results from the use of fertilizers and manure, cropping systems followed, and farm practices in general. The approximate location of the farms studied is shown in figure 1,

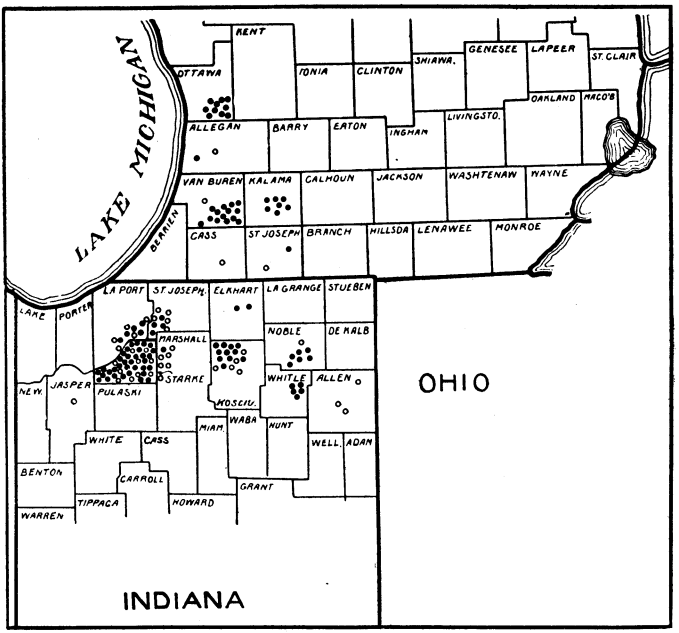

FIG. 1.—Map of area showing the approximate location of the farms studied.

black dots indicating farms studied in detail, circles indicating the locations of other farms visited.

The objects of this investigation were (1) to study the organization of muck-land farms in a representative area; (2) to determine the most reliable practices in the management of muck farms of different types; (3) to compare intensive and extensive farming on muck soil; (4) to determine the most profitable methods of utilizing unimproved muck land.

SUMMARY.

1. Four distinct types of farming are practiced on muck lands in northern Indiana and southern Michigan, viz, celery, onion, peppermint, and grain-and-stock farming.

2. The muck soil of this region is well suited to the growing of celery, onions, peppermint, cabbage, corn, and hay, and, when properly fertilized or manured, is fairly well adapted to oats, wheat, and rye.

3. *The use of fertilizer, especially potash, on muck soils is very profitable, the yields being increased in most cases from 50 to 200 per cent.* Manure also gives excellent results.

4. Celery and onions require an enormous amount of man labor as compared with corn, oats, and hay. Peppermint, cabbage, and potatoes occupy an intermediate position with regard to man labor.

5. *The gross acre value of intensive crops is high, but the value of these crops per day of man labor is not as high as in the case of extensive crops.*

6. The average labor income for 28 celery farms was $394; for 23 onion farms, $1,732; for 10 peppermint farms, $1,519; for 39 grain and stock farms, $1,056; and for 7 of the more successful grain-and-stock farms, $1,994

7. The expense for fertilizer and labor per crop acre is much greater on celery and onion farms than on peppermint and grain-and-stock farms.

8. Grain-and-stock farms provide a much better distribution of labor throughout the year than do celery, onion, or peppermint farms.

9. *Grain-and-stock farming is a much safer type of farming than any intensive type, although the profits per acre may be much less.*

10. *A small muck farm, even though operated intensively, will usually return only a moderate labor income.*

11. Tile drains were used on most of the muck farms studied. The best results have been obtained with 5 or 6 inch laterals laid 5 to 12 rods apart and at a depth of 3½ to 4 feet, although small open ditches are very satisfactory in some cases, especially on the celery farms.

12. The growing season on muck land is considerably shorter than on other land in the same region, on account of later frosts in the spring and earlier frosts in the fall.

13. Nearness to a market or shipping point is of great importance in the profitable production of truck crops.

TYPES OF FARMING.

Muck lands are adapted to many different crops, some of which form special industries of considerable magnitude. In the development of new areas of these lands, it is an important question whether to attempt this development along intensive or extensive lines, whether to grow the crops which produce large returns per acre or those which give large returns per man. Figure 2 shows a typical muck-land area developed along intensive lines.

The admirable adaptability of muck soils to highly intensive types of farming, such as truck growing and market gardening, has led to the popular belief that all muck soils should be farmed intensively. In this connection, however, a few facts are significant. In eight of

the North Central States—Ohio, Indiana, Michigan, Illinois, Wisconsin, Minnesota, Iowa, and Missouri—there are 15,000,000 acres of swamp lands, which consist largely of muck soils capable of being drained and utilized for agricultural purposes. In the entire United States in 1909 there were approximately 125,000 acres of cabbage, 50,000 acres of onions, 15,000 acres of celery, and 8,000 acres of peppermint and spearmint, making a total for the five crops of only 198,000 acres, a large percentage of which, moreover, consists of areas other than muck. That the production of these crops is sufficient at present is evidenced by the frequent overproduction of one or more of them. Indeed it seems quite possible that all of the celery, onions,

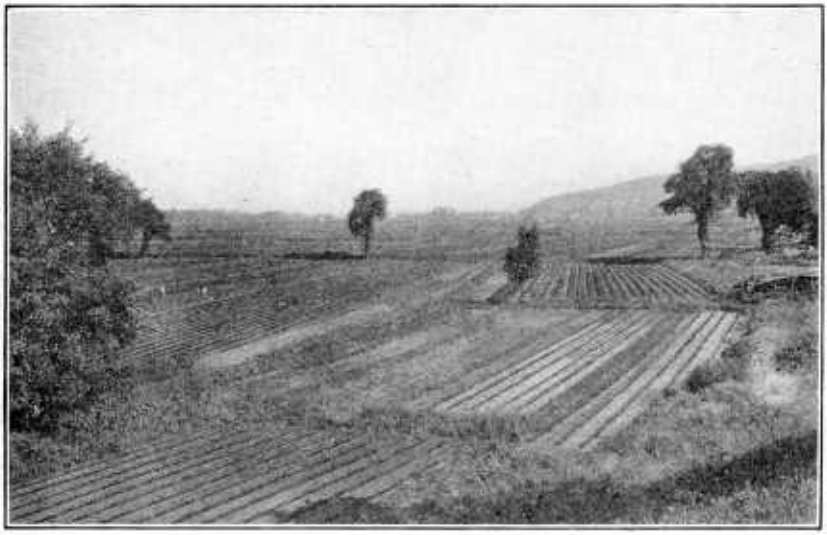

FIG. 2.—Muck land devoted to celery and other intensive crops.

mint, and cabbage needed by the whole United States could be grown on 1 or 2 per cent of the muck land in the eight States mentioned above.

INTENSIVE AND EXTENSIVE CROPS.

The most important and fundamental difference between intensive and extensive farming is the relative difference in the amount of labor required to farm a given area. This difference is not generally fully appreciated. As shown in figure 3, celery and onions require an enormous amount of man labor as compared with corn, oats, and hay. Cabbage, potatoes, and peppermint, with respect to labor, occupy an intermediate position between the highly intensive crops on the one hand and extensive crops on the other. Onions require less horse labor than celery, cabbage, and potatoes, because the cultivation of onions is all done with hand implements.

If the labor requirement and its distribution are known for a crop and also the time available for crop work during the year, it is possible to determine with a fair degree of accuracy the number of acres of crops or combination of crops that can be cared for by one man. Figure 4 shows the approximate number of acres of a number of the

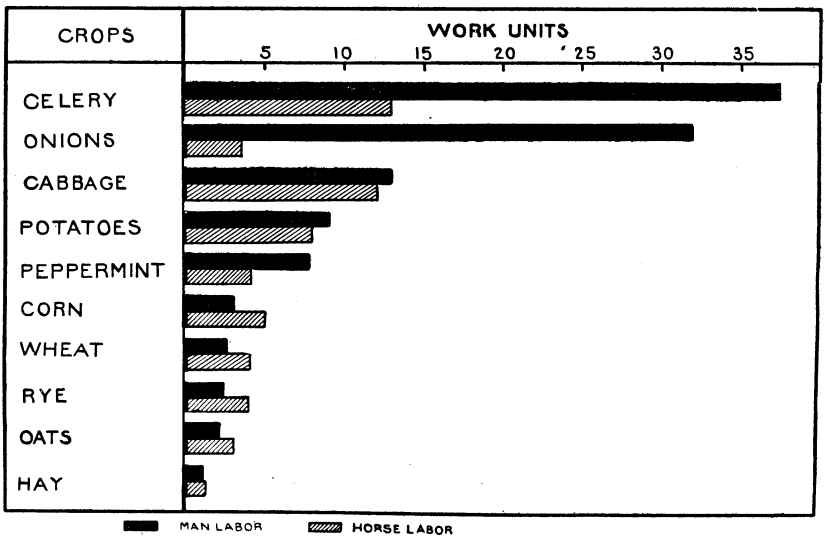

FIG. 3.—Days of man and horse labor required per acre by the more important crops grown on muck soil in northern Indiana and southern Michigan.

more important crops and one crop combination that can be cared for by one man. Here it is easily seen that one man can raise only a few acres of the more intensive crops without employing extra labor, but that he can handle a relatively large acreage of extensive crops,

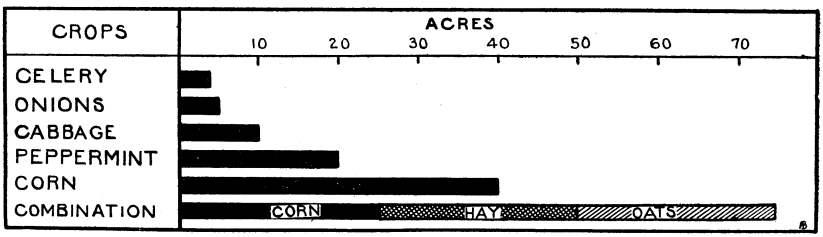

FIG. 4.—Approximate number of acres that can be worked by one man in different crops.

especially if these are combined in such a way as to give a fair distribution of labor.

Another good comparison of intensive and extensive crops is shown in Table 1. The gross acre value of intensive crops is high, the average for five important crops being slightly over $100 per acre, but the average gross value produced by each day of man labor is only

$5.54, while for five important extensive crops the gross value of crops produced is $8.73 per day of man labor, but only $18.19 per acre.

TABLE 1.—*Gross value per acre, and per day of man labor.*

[Averages for 100 muck-land farms in northern Indiana and southern Michigan.[1]]

Crop.	Gross value produced.	
	Per acre.	Per day of man labor.
Corn	$30.08	$10.03
Hay	12.84	12.84
Onions	176.82	5.53
Oats	15.57	7.78
Potatoes	35.97	4.00
Wheat	19.28	7.71
Celery	161.52	4.31
Peppermint	64.70	8.09
Rye	13.20	5.28
Cabbage	69.30	5.77
Average for extensive crops[2]	18.19	8.73
Average for intensive crops[2]	101.66	5.54

[1] Figured on basis of average farm price and yield for 1914, and average labor requirements.
[2] Onions, potatoes, celery, peppermint, and cabbage are considered intensive and all the others extensive crops.

Even on muck soil, which is especially well suited to intensive farming, large profits on small farms are the exception, not the rule, although the small farmer can make a better living on muck soil than on types of soil not so well suited to intensive crops, especially if he has available family labor. As a rule farmers who have some capital and can afford to hire most of their labor will find intensive farming more profitable than will farmers who have to depend largely on their own labor. However, they must understand their business thoroughly and be able to handle men efficiently. On the other hand, men with relatively large farms, who must depend largely on their own labor or the labor of members of the family, will probably make better labor incomes if they raise extensive crops. It may be advisable to introduce into an extensive system of farming on muck soil a small acreage of some intensive crop to provide a better distribution of labor or profitable employment of children during their summer vacation from school.

FAVORABLE AND UNFAVORABLE CONDITIONS.

Many conditions, some favorable, others unfavorable, influence type of farming. The adaptation of crops to soil and climatic conditions; crop yields; the price of products; markets; cost of feed; availability, cost, and seasonal distribution of labor; the ravages of insects and of plant and animal diseases all have their influence in determining type of farmimg in any locality.

On muck lands frost is an important determining factor. The growing season on such soil is considerably shorter than on other soils in the same region. In northern Indiana and southern Michigan the earliest frost on these lands sometimes occurs as early as September 1 and the latest as late as June 10.

These conditions have been summarized for the more important muck-farm enterprises of this region in Table 2.

TABLE 2.—*Favorable and unfavorable conditions affecting types of farming on muck land in northern Indiana and southern Michigan.*

Farm enterprise.	Favorable conditions.	Unfavorable conditions.
Corn	Good yield and price, labor cost low	Danger of frost in spring and fall; weeds frequently troublesome.
Onions	High yield per acre and possibility of very large income per acre.	Fluctuations in price great; weeds hard to control; large amount of labor required; insect enemies.
Celery	Muck soil best for celery; large income per acre.	Large amount of labor required; danger of blight and rotting; price unstable.
Peppermint	Muck soil best for peppermint; possibility for very large income per acre with moderate amount of labor.	Demand very limited; fluctuation in price great; expensive equipment needed.
Potatoes	Easy to plant, cultivate, and harvest potatoes on muck.	Market discrimination against muck potatoes.
Hay	Yield good; price fair; labor cost very low.	Quality of muck hay sometimes poor due to rust.
Oats	Yield and price fair; labor cost low; good feed.	Danger of frost in spring and lodging at harvest time.
Wheat	Good yield; price stable; labor cost low.	Frequently heaves badly in winter, hard to get firm seed bed.
Rye	Good value as feed	Yield and price usually low.
Hemp	Good income per acre	Large amount of skilled labor required.
Cabbage	Possibility of good income per acre	Fluctuation in price; danger of rotting; large labor requirements.
Live stock	Good pasture and abundance of feed crops; value of manure.	High price of feed.

YIELDS AND PRICES FOR 1914.

Table 3 shows the average yield per acre, the disposition of crops, and the average prices received in 1914 as compared with the average prices [1] for the 10-year period 1905–1914.

There is a considerable difference between the average prices for 1914 and the 10-year average, but a little study shows that these differences just about counterbalance each other, so that considered as a whole, the farm receipts in 1914 were practically normal, although onion and peppermint farmers received somewhat less than normal prices for their principal products, while grain farmers received an abnormally high price for corn.

The yields of corn, wheat, and peppermint were slightly above the average in 1914, while other crop yields were almost normal.

[1] Farm prices received for onions, celery, and peppermint were estimated from trade journal quotations; other figures are from reports of the Bureau of Crop Estimates, Department of Agriculture.

TABLE 3.—*Average yield, per cent sold, and price (1914 and 10-year average), for 11 principal crops grown on 100 muck-land farms, northern Indiana and southern Michigan.*

Crop.	Number of farmers growing.	Average yield per acre.	Per cent sold.	Average price received, 1914.	Average price, 1905–1914.
Corn.....bushels..	77	47.0	44.5	$0.64	$0.52
Hay.....tons..	68	1.2	26.7	10.70	11.90
Onions.....bushels..	50	421.0	100.0	.42	[1].51
Oats.....do....	43	36.2	47.2	.43	.38
Potatoes.....do....	42	105.8	74.4	.34	.55
Wheat.....do....	39	23.8	91.0	.81	.91
Celery.....dozen..	32	1,346.0	100.0	.12	[1].11
Peppermint oil.....pounds..	29	37.4	100.0	1.73	2.37
Rye.....bushels..	18	17.6	56.2	.75	.66
Hemp.....pounds..	3	1,170.0	100.0	.04	[2]
Cabbage.....tons..	2	15.0	100.0	4.62	[2]

[1] Average price, 1907–1915.
[2] No reliable data available

CELERY FARMING.

Figure 4 shows the average number of acres of each crop grown, the average amount of live stock kept, and the percentage of receipts from each farm enterprise on 28 celery farms in Michigan. Most celery farms are of from 5 to 10 acres and have a large proportion of this area in celery. A few farms are included in the average which, although they are distinctly celery farms, have considerable acreages of other crops. Hence the average of these 28 celery farms contained 15.2 acres of tillable land with 6.3 acres in celery. Most of the growers near Decatur, Mich., raise a few acres of peppermint, which is a very good practice. A few onions, grown on most of these farms, add to the diversity of the farm business and hence to the stability of the income.

The live stock kept on celery farms usually consists of a cow, a horse, and a few chickens. A few of the farms included in the average had several cows and two horses, which accounts for the cattle and horses shown in figure 5.

On these 28 celery farms, 76.3 per cent of the total farm receipts came from the sale of celery. Mint oil, dairy products, and onions made up 16 per cent and other much less important enterprises brought in the rest of the total farm receipts.

The celery of this region is grown chiefly in the vicinity of Kalamazoo, Decatur, and Hudsonville, Mich. Smaller acreages are grown in various other localities in Michigan, but very little is raised in Indiana. There are many other muck areas in both States in which celery could be grown successfully. Most of it is raised by Hollanders who settled in localities where conditions are particularly favorable to celery culture. Approximately 3,000 acres are raised annually in Michigan.

Most of the Michigan celery is shipped by express and placed on the market in a few days after it leaves the farm. A few growers

ship it crated "in the rough." In this case it is packed in crates, shipped by freight, stored, and often kept for a considerable time. A large part of the Michigan celery goes to the Chicago market, but it is also shipped to many other points.

Much skill is required in the production of celery, and the wages paid for hired labor are proportionately high. Neither is it work which small children can do efficiently, but boys 16 years of age and over are frequently very skillful. Hence the celery grower raises, as

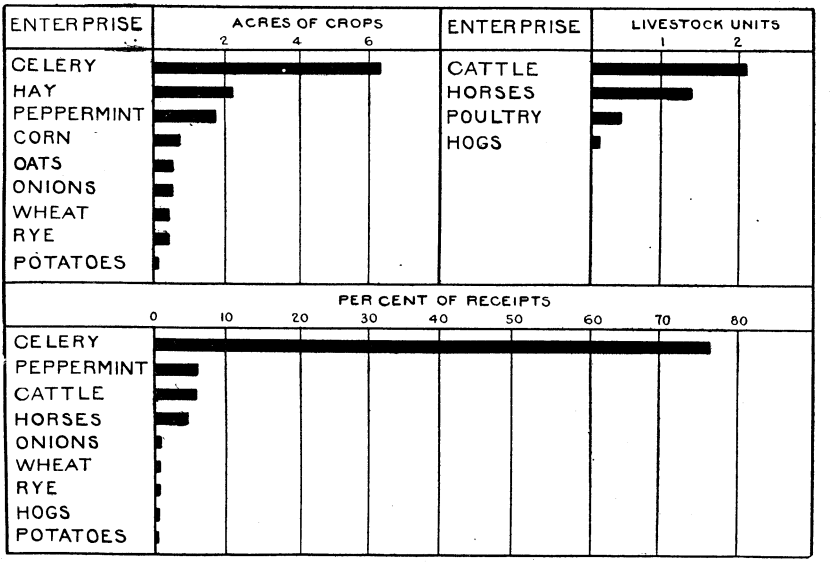

FIG. 5.—Number of acres of each crop grown, average number of livestock kept, and percentage of receipts from each farm enterprise on 28 celery farms in Michigan.

a rule, only as many acres as he can handle himself, or with the help of his boys.

ONION FARMING.

Most onion farmers raise enough hay and corn to feed, but depend upon onions as the chief source of income. The 15.7 acres of onions raised on these farms occupied less than one-fourth of the total average crop area, but required a great deal more labor than all other farm enterprises. (See fig. 3.) Figure 6 shows the average number of acres of each crop grown, the number of live stock kept, and the sources and percentage of receipts on 23 onion farms in northern Indiana.

As a rule, celery is not grown as a side line on onion farms, although onions are frequently raised in small quantities on celery farms. In fact, many farmers on muck land raise some onions even though their principal income is derived from other sources. Children from 10 to 16 years of age, properly directed, can do the handwork on

onions even more efficiently than men, and this work comes at a time when they are out of school. Many children from cities and towns, as well as from the farms, are thus given profitable employment in the onion fields during the summer.

A few men grow onions exclusively, but they usually have considerable capital and can withstand occasional heavy losses due to overproduction, the ravages of disease and insects, or destruction by floods or windstorms. Such a system of farming is not practicable except in localities where labor is plentiful during the summer months. Onions alone give a very poor distribution of labor.

The live stock kept on an average onion farm consists of a few cattle and hogs in addition to the work horses. Horse labor is

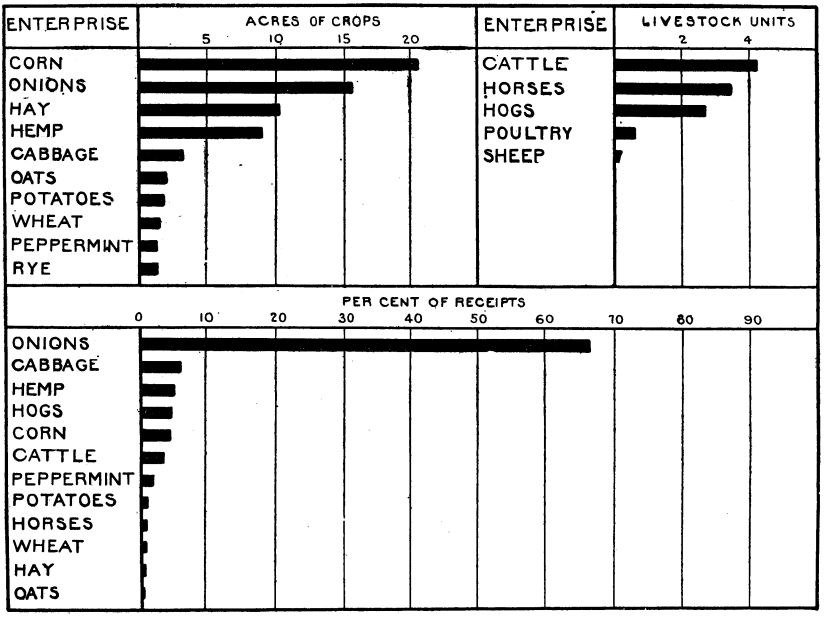

FIG. 6.—Number of acres of each crop grown, average number of livestock kept, and percentage of receipts from each farm enterprise on 23 onion farms in northern Indiana.

employed in preparing the seed bed in the spring and in harvesting the crop in the fall. All cultivating and weeding must be done by hand, or with hand tools. Horse tools are not used in the cultivation of onions, hence they provide a much poorer distribution of horse labor than celery. It is largely for this reason that onions are grown in connection with other crops.

On the 23 onion farms studied, 66.3 per cent of the total farm receipts came from onions, all other receipts being derived from minor farm enterprises. Two farms sold a total of $4,697 worth of hemp, and one farm sold $5,700 worth of cabbage. Grain and live stock were sold in very limited amounts.

From 4,000 to 6,000 acres of onions are grown annually in northern Indiana, while only 1,000 to 1,500 acres are grown in Michigan. The acreage grown varies greatly from year to year.

Some of the large growers own storage houses and are able to hold their onions for the winter market, but most of them sell to commission men at harvest time. Onions produced in this region must be marketed about March 1 because Texas onions come on the market shortly after this date. (For full information on onion culture see Farmers' Bulletin No. 354.)

PEPPERMINT FARMING.

Peppermint was grown on 29 of the farms studied, but only 10 were distinctly peppermint farms. Like onion farmers, peppermint

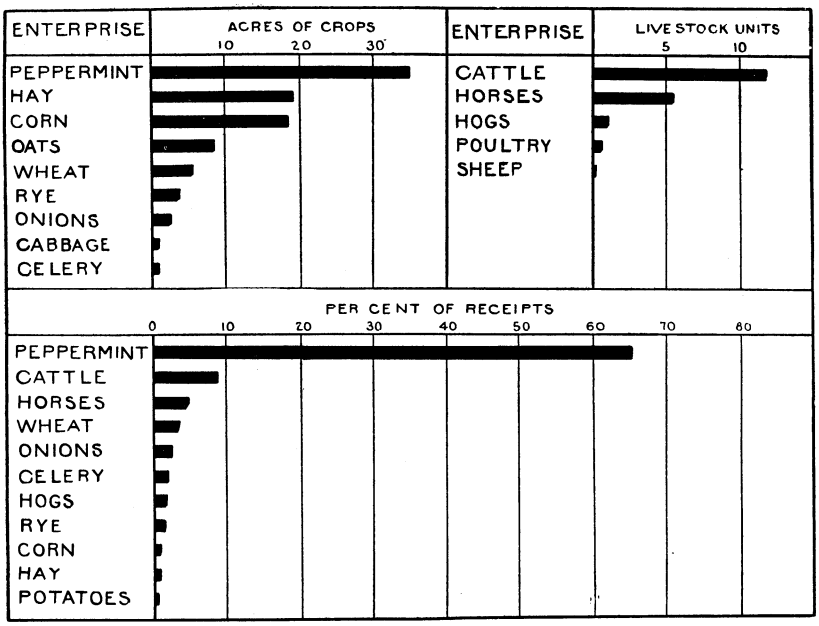

FIG. 7.—Number of acres of each crop grown, average number of livestock kept, and percentage of receipts from each farm enterprise on 10 peppermint farms in northern Indiana and southern Michigan.

farmers usually raise enough grain and hay to feed, but very little to sell. These ten mint farmers raised an average of 35 acres of peppermint, 18.3 acres of corn, and 19.1 acres of hay. Most of the hay on these farms is made as a by-product from the peppermint after the volatile oil has been extracted by distillation. The refuse from the stills is scattered, dried, and made into hay. On large mint farms much of the refuse is returned to the fields as manure. (For further information on the growing of peppermint and spearmint see Farmers' Bulletin No. 694.) Figure 7 shows the average number of acres of each crop grown, the number of live stock kept, and the percentage of receipts from different sources on these 10 farms.

Aside from work horses, cattle are about the only live stock kept on mint farms. Pasture is abundant in summer, and cows or steers can be wintered largely on mint hay.

The production of peppermint and spearmint is a highly specialized and also a highly localized industry. The oils are used entirely for medicinal and flavoring purposes, and the current demand is met by production practically confined to a few thousand acres of muck land in northern Indiana and southern Michigan. Any material increase in acreage results in a corresponding reduction in price, so that it may be assumed that the acreage devoted to these crops is about as large as the present market justifies. The acreage of spearmint is only a small part of the total area of both crops.

In the extraction of the essential oil from these plants, a somewhat expensive equipment is necessary. Hence the growers must either plant an acreage large enough to justify the installation of a still, or arrange to have the distilling done on a neighboring farm. Partnership equipment is common, and there are many farmers raising only a few acres of mint as a side line who have the service of a neighborhood still. Most of the peppermint and spearmint is grown by a few men who have had long experience in the business.

GRAIN-AND-STOCK FARMING.

Some grain was grown and some live stock kept on almost every farm studied, and 39 farms are classed as distinctly grain-and-stock farms. The principal crops were corn, oats, wheat, and hay, in the order named. Potatoes, rye, onions, and peppermint occupied only minor positions in the cropping system. Hemp was grown on one farm in this group. Figure 8 shows the average number of acres of each crop grown, the number of live stock kept, and the percentage of receipts from differ ent sources for these farms.

The live stock kept consisted of cattle, horses, and hogs. Cattle and hogs are both well adapted to the muck-land farms of this region on account of the abundance of pasture, grain and hay. Furthermore, cattle assist in compacting the soil.

Corn, hogs, wheat, and cattle, in the order named, were the principal sources of receipts. Most of the hay and a large part of the oats raised were fed to the live stock.

In the past attention has been given chiefly to the development of muck lands along the intensive lines, but it is now plainly evident that if large areas of these lands are to be utilized, extensive systems of farming must be developed. Hence a study of some of the more successful grain-and-stock farms will be especially valuable in this connection. In the above mentioned group of 39 farms seven were located on typical deep muck soil and grew almost exclusively corn, oats, wheat, and hay. These farms varied in size from 160 to 420 acres, the average being 281.1 acres, with 253 acres of tillable land.

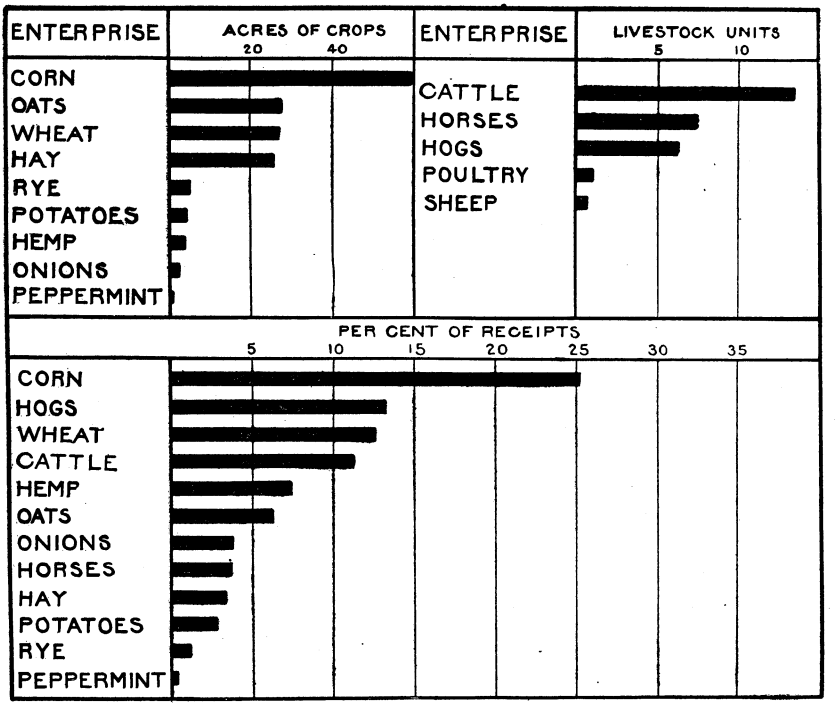

FIG. 8.—Number of acres of each crop grown, average number of livestock kept, and percentage of receipts from each farm enterprise on 39 grain-and-stock farms in northern Indiana and southern Michigan.

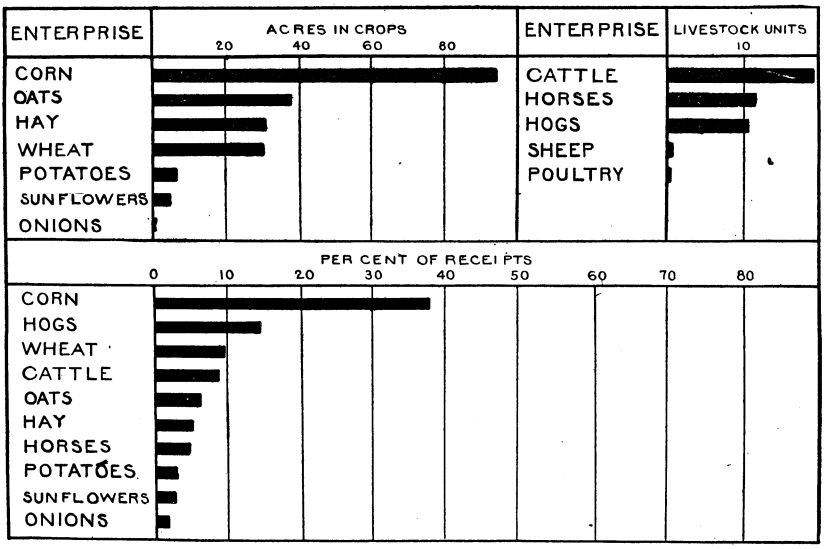

FIG. 9.—Number of acres of each crop grown, average number of livestock kept, and percentage of receipts from each farm enterprise on 7 successful grain-and-stock farms in northern Indiana.

Figure 9 shows the average crop acreage, number of live stock kept, and sources of receipts for these seven general farms.

The principal sources of receipts were corn, hogs, wheat, and cattle. Crop yields and quality of live stock on these farms were somewhat above the average, but not exceptional. The average yield of corn was 55 bushels, of oats 38, wheat 26, and hay 1.3 tons per acre. The owners of these farms spent an average of $179 each for fertilizer, mostly potash, which accounts in large measure for their good yields. Two of them sold no corn, feeding it all to live stock, while only three sold hay in any considerable quantity. One man sold 105 tons at $13 per ton, clear of baling and shipping charges. Hay requires less labor than any other crop, and yet yields well and usually commands a fair price. The acreage of muck land devoted to the growing of timothy hay should be materially increased in this and other muck-land regions.

INVESTMENT, RECEIPTS, AND PROFITS.

The difference between the receipts and expenses of a farm is called the "farm income." If he is free from debt, the farmer has this amount of money for defraying the living and personal expenses of himself and family, and for savings or investment. The farm income takes no account of the capital invested, and hence is not a measure of the efficiency of the farmer or of his farming system. If, however, the customary rate of interest on the capital invested is charged as a farm expense and deducted from the farm income, the remainder thus obtained represents the real earning power of the farmer under his conditions. This figure is called the "labor income," and, as the name implies, it represents the wages which the farmer receives for his labor and managing ability after making due allowance for interest on investment.

Table 4 shows the average size, capital, receipts, and profits for the types of farms included in this study.

TABLE 4.—*Relation of type of farming to receipts, investment, and labor income on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Type of farming.			
	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Averages per farm:				
Acres of land	19.2	104.0	148.6	235.0
Total capital	$5,630	$12,611	$16,410	$27,673
Receipts from onions	63	2,792	88	138
Receipts from celery	1,079		68	
Receipts from peppermint	83	76	2,365	12
Receipts, grain and hay	9	215	223	1,810
Receipts from live stock	124	421	592	1,170
Receipts, other sources	56	709	218	427
Total receipts	1,414	4,213	3,554	3,751
Farm income	675	2,363	2,339	2,440
Labor income	394	1,732	1,519	1,056

The celery farmer, with an average of 19.2 acres, and an investment of $5,630, made a labor income of $394. Although this is not large, it is nevertheless a fair income, and equal to the incomes earned by farms of two or three times the size in many sections of the country. Twenty-three onion farms, with an average of 104 acres, and an average total investment of $12,611, made labor incomes averaging $1,732. The average onion farm, however, was more than five times as large as the average celery farm, and represented a total investment of more than twice as much capital. Ten peppermint farms, with an average of 148.6 acres, and an investment of $16,410, made labor incomes averaging $1,519, while thirty-nine grain-and-stock farms, with an average of 235 acres, and an investment of $27,673 earned labor incomes of $1,056.

The seven more successful grain-and-stock farms shown in figure 8 made labor incomes averaging $1,994. Their average size was 281 acres, and average investment $41,795.

The above labor incomes were made in 1914. These are not fixed quantities and will vary from year to year. Profit in onion, peppermint, and celery farming varies much more than in grain-and-stock farming because of greater variation in both yields and prices.

DISTRIBUTION OF EXPENSES.

The operating expenses run highest on celery and onion farms. The percentage of expense for labor is considerably higher on onion farms than on any other type. On celery farms the operator does most of the work himself, so that his actual expense for labor is low.

The expense for feed purchased is high on celery farms, since celery farmers raise very little feed. The expense for fertilizer is next to that for labor in importance, the average for all the farms being 9.9 per cent. The expense for seed is highest on onion farms. The percentage of receipts required for operating expenses and the percentage of the current expenses represented by the expenses for labor, feed, fertilizer, and seed on the various types of farms are shown in Table 5.

TABLE 5.—*Relation of type of farming to the distribution of current expenses on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Type of farming.			
	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Average total investment	$5,630	$12,611	$16,410	$27,673
Percentage of receipts required for operating expenses	46.9	40.5	28.1	30.5
Percentage of expenses for labor [1]	38.6	60.3	45.6	43.0
Percentage of expense for feed	17.0	4.6	1.7	5.1
Percentage of expense—fertilizer	10.5	9.9	13.9	8.7
Percentage of expense—seeds, etc	3.6	18.7	1.9	4.6
Percentage for other expenses	30.3	6.5	36.9	38.6
Total expenses	100.0	100.0	100.0	100.0

[1] Includes hired labor and allowance for unpaid family labor other than the operator's.

COST OF LABOR AND FERTILIZER.

The cost per crop acre of the two most important items of expense, viz, labor and fertilizer, for the different types of farms is shown in Table 6.

TABLE 6.—*Relation of type of farming to cost of fertilizer and labor per crop acre on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Type of farming.			
	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Cost of fertilizer per crop acre	$5.18	$2.36	$1.43	$0.62
Total cost of labor per crop acre	$50.00	$22.00	$9.00	$6.00

This table shows clearly the large amount of labor required by celery and onions. It should be borne in mind in comparing these labor costs that they are for all crops, and that the celery farm ordinarily has a larger percentage of the farm area in celery than the onion farm has in onions. Peppermint and grain-and-stock farming require relatively a small amount of labor. Almost the same relation exists between the fertilizer cost per crop acre and type of farming.

LABOR INCOME AND LABOR COST.

Table 7 shows, in addition to labor income, the total value of the labor required to operate the various types of farms, and the labor incomes of the operator per day. The total value of labor is the sum of the amount spent for hired labor, the value of the labor performed by members of the farm family, and the value of the farmer's own labor. The labor income per day is obtained by dividing the labor income by 300. This, however, is only of incidental interest.

TABLE 7.—*Relation of type of farming to total cost of labor and labor income on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Labor income	$394	$1,732	$1,519	$1,056
Total value of labor	$678	$1,559	$895	$1,034
Operator's labor income per day	$1.31	$5.78	$5.06	$3.52

NET RETURNS FOR PRODUCTIVE LABOR.

The number of crop acres per man is a good index of the degree of intensity of the different types. Celery growers do not grow much of anything else; onion and peppermint farmers, however, usually

grow a considerable acreage of more extensive crops (see fig.6); while grain-and-stock farmers raise little but extensive crops. Celery requires a large amount of horse labor, while onions and peppermint require little more than extensive crops. The relation of type of farming to a number of the important factors of farm efficiency is shown in Table 8.

TABLE 8.—*Relation of type of farming to factors of efficiency on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Type of farming.			
	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Crop acres per man	7.5	21.0	40.6	73.0
Crop acres per horse	9.6	22.3	21.2	24.3
Productive work units per man	159.0	198.6	238.9	294.1
Productive work units per horse	76.9	104.4	82.6	97.0
Cost of man labor per productive work unit [1]	$2.37	$2.31	$1.56	$1.60
Labor income for each productive man work unit [2]	$1.38	$2.56	$2.65	$1.63
Value of productive work unit of operator [3]	$2.48	$8.72	$6.36	$3.58

[1] Obtained by dividing the total value of labor by the total productive man work units.
[2] Obtained by dividing the labor income by the total productive man work units.
[3] Obtained by dividing the labor income by the productive work units per man.

The number of productive work units[1] (or days' work) per man varies greatly on farms of different types for a number of reasons. Grain-and-stock farming furnishes the best distribution of labor throughout the year. In this group there were 294.1 productive work units per man or a day's work for each man employed for almost every work day in the year. On the peppermint farms there were only 238.9 units of productive work per man, owing to a less satisfactory distribution of labor. Onion and celery farms use labor still less efficiently. Celery farmers are also the least efficient users of horse labor. The cost of man labor for each productive work unit is highest on celery and on onion farms, and lowest on grain-and-stock farms. The labor income for each productive work unit of the operator is shown in the last line of Table 8.

INCOME PER WORKER EMPLOYED.

The labor income per man for the various types of farms studied in 1914 is shown in Table 9. This was obtained by dividing the average labor income plus the expense for labor by the average number of men employed on the farm, including the operator. The labor income per man is lowest on the average celery farm, which represents

[1] A work unit, as the term is used in this bulletin, is an average day's work for a man or a horse. A productive work unit is an average day's work at any farm enterprise which adds directly or indirectly to the gross income of the farm. Work done in the production of crops and caring for dairy cows, hogs, feeding steers or sheep, is productive labor, but time spent in repairing buildings, fences, or machinery and in caring for work horses is unproductive labor and is not included.

the most intensive type. On grain-and-stock farms the labor income per man is comparatively high, averaging almost as much as on onion and peppermint farms, and some years going even higher than on the specialized farms.

TABLE 9.—*Relation of type of farming to the labor income per worker on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Types of farming.			
	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Average number of workers	1.8	3.4	2.4	2.2
Labor income per worker	$361	$813	$823	$702

TOTAL AND WORKING CAPITAL AND VALUE OF REAL ESTATE PER ACRE.

The relation of type of farming to the area of tillable land, to the investment, value of real estate per acre, and miles to market is shown in Table 10.[1]

TABLE 10.—*Relation of type of farming to area of tillable land, total investment, working capital, and value of real estate per acre on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Type of farming.			
	Celery.	Onion.	Peppermint.	Grain-and-stock.
Number of farms	28	23	10	39
Average area of tillable land	15.2	84.4	119.4	195.6
Average capital	$5,630	$12,611	$16,410	$27,673
Average working capital	$713	$2,260	$2,610	3,234
Working capital per acre of tillable land	$47	$27	$22	$16
Value of real estate per acre	$378	$101	$109	$105
Average distance to market, miles	1.1	3.1	2.8	3.7

It is evident that celery farms have the least working capital but the greatest amount of working capital per acre of tillable land. Thus intensive types of farming require more working capital per acre than is required by extensive types.

The value of real estate on onion, peppermint, and grain-and-stock farms is only slightly above $100 per acre, but in the case of the celery farms the value of the real estate rises to $378 per acre, partly owing to the greater proportionate value of the buildings and partly to the fact that celery farms are highly developed and very close to market.

[1] Working capital is the sum of the investments in live stock, machinery and equipment, feed and supplies, and cash for current expenses.

RISK AND PROFIT.

In all types of farming there is an element of risk due most largely to fluctuations in prices of farm products and variations in yields of crops from year to year. In the more extensive and stable types of farming this element of risk is not large, though it is, nevertheless, an important factor; but in the more intensive types, such as truck and fruit growing, it is responsible alike for startling successes and for disastrous failures.

Farmers of course realize that their profits depend largely upon conditions over which they as individuals have little or no control and that all farming is accompanied by considerable risk. They also realize that the risk varies with different types of farming. For the country as a whole, and to a less extent for the principal producing centers, a low yield of a crop results in a correspondingly high price, and vice versa. The farm price of potatoes in Indiana is influenced very materially by the yield in Michigan and Wisconsin, because the latter States are great potato-producing centers and serve the same markets as Indiana. The price of onions in Ohio is influenced by the yield of onions in New York and Indiana for a similar reason, but the price of oats in Pennsylvania is determined largely by the yield of oats in the central west because the Pennsylvania crop is too small to affect the market, the price being determined by the supply in the great center of oat production. Thus, in any given locality, the fluctuation in prices from year to year has a much greater effect on farm profits than variations in yield. This is especially true of crops which are consumed in relatively small quantities, such as vegetables and fruits.

The risk involved in onion, celery, and peppermint farming is much greater than in grain-and-stock farming, because of the much wider price variations in the onion, celery, and peppermint markets, than in the grain and live stock markets.

Figure 10 shows the variations in the yearly average wholesale price of onions, celery, and peppermint for the last nine years. The farm price of these products varies even more than is indicated by the wholesale price range, for when market quotations are low and sluggish, commission men have to figure on a larger margin of profit than when prices are good. For example, in 1912 the average market quotation for onions was $0.49 per bushel, but buyers would only pay the farmer $0.20 to $0.30. So many farmers stored their crop that during the following winter the price went so low that thousands of bushels were hauled out to rot on the fields. As a result of this overproduction the acreage of onions was much reduced in 1913 and the price was correspondingly high. The variation in price for celery and peppermint, while not so great as for onions is such as to indicate that these, too, are hazardous types of farming.

Thus the profits of the special types of farming are very uncertain, while in grain-and-stock farming the profits are much more dependable from year to year. It is also highly probable that, through a period of years, the average profits in grain-and-stock farming will be larger than for any special type where similar amounts of capital and labor are involved.

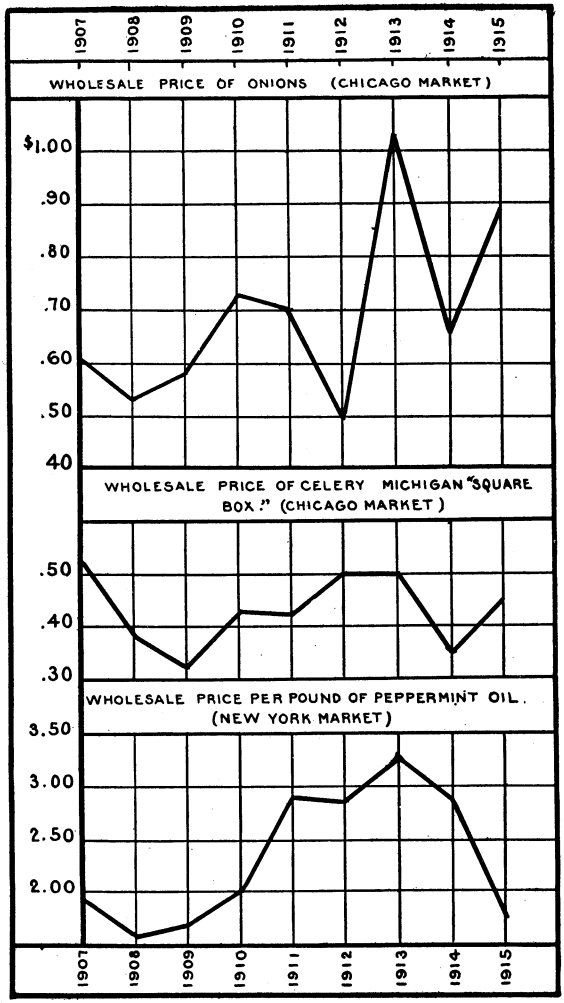

FIG. 10.—Variations in the average wholesale price of onions, celery, and peppermint, 1907 to 1915.

SIZE OF THE FARM BUSINESS AND PROFIT.

There are a number of ways of measuring the size of business on a farm and its effect on profits. In regions where a fairly uniform degree of intensity prevails, the total area of the farms, the area of improved land, and the crop area are all very accurate measures of size of business. But in regions where there are marked differences in intensity of farming, the sum of the interest on total capital, current expenses, depreciation and repairs, and value of the operator's labor[1] is the most accurate measure of the size of the farm business. This measure has been used in this study. In the tables it

[1] In studying the effect of size of business on profit, the farms were divided into four groups according to total expense, as follows: Group I included all farms on which the total expense was less than $1,000; Group II, total expense from $1,000 to $2,500; Group III, from $2,500 to $4,000; and Group IV, total expense over $4,000. It will be noticed that the average total expense in Group II is almost exactly twice as large as in Group I, and also that the average total expense of Group III is again twice as large as Group II and that the same relation exists between Group IV and Group III.

is called "Total expense." It might also be called the "Total cost of operating the farm."

The relation of size of business to farm income, labor income, and percentage earned on investment is shown in Table 11. The average farm incomes are directly proportional to the size of business as measured by total expenses and the average labor incomes increase at almost the same rate, but in general the percentage of income on investment remains the same for all sizes of business. The small farms made somewhat higher relative profits than large farms, but their actual labor incomes are small compared with the labor incomes of the larger farms.

TABLE 11.—*Relation of size of business to relative profit on 100 muck farms in northern Indiana and southern Michigan.*

Item.	Group I.	Group II.	Group III.	Group IV.
Number of farms	14	46	27	13
Average acreage	18.4	88.4	182.0	336.0
Average total capital	$2,884	$9,718	$23,651	$43,467
Average total expenses	$809	$1,632	$3,128	$6,502
Average farm income	$647	$1,136	$2,471	$4,899
Average labor income	$503	$650	$1,288	$2,732
Percentage of income on investment when value of operator's labor is deducted	10.0	8.0	8.2	9.7

DEVELOPMENT AND MANAGEMENT OF MUCK LAND.

In the development of new muck land and in establishing profitable types of farming upon it, a number of factors must receive careful consideration. Among these are distance to market, land clearing, drainage, soil management, and the selection of proper crops. Owing to the fact that muck soils are capable of supporting such a variety of types of farming, it is usually possible to adjust a system of farming to whatever conditions are encountered. Such staple crops as corn, hay, oats, and wheat are being grown more and more on muck land, and the acreage of these crops can be greatly extended without materially affecting prices. It is evident, therefore, that extensive types of farming should predominate on the greater part of this land.

DISTANCE TO MARKET.

All practical truck growers realize the importance of locating near a market or shipping point, but many beginners in the business make the mistake of locating so far from a market that the cost of hauling the products greatly reduces the profits or consumes them entirely.

The relation of distance to market to the value of muck land is shown in figure 11. The size of the farms increases with the distance to market, while the value per acre decreases rapidly. At 4 miles from market or shipping point this muck land has lost much of its value for trucking. At a distance of 5 or 6 miles from market muck

land is worth as much for extensive as for intensive farming. This relation may be changed in the future by the introduction of cheaper methods of transporting bulky products from the farm to the market or shipping point, but it will always have much influence on type of farming and the utilization of new muck land, and should be a matter of important consideration for those who contemplate locating on this type of soil.

CLEARING MUCK LAND.

The cost of clearing muck land depends altogether upon the character of the native vegetation. A great deal of this land requires practically no clearing, being covered with a good sod of wild grasses and a few shrubs, as is shown in figure 12. This is true of very large areas of marsh land in Indiana, Michigan, and neighboring States. Muck land which has supported a growth of tamarack, black ash, or elm can usually be cleared at a cost of from $15 to $30 per acre, although in some cases the cost may be as high as $75 to $100 per acre. As a rule swamp-land stumps are shallow rooted and the soil is loose so that they can usually be pulled with a team and a simple stump-pulling device. (For further information on clearing land see United States Department of Agriculture Bulletin No. 91.)

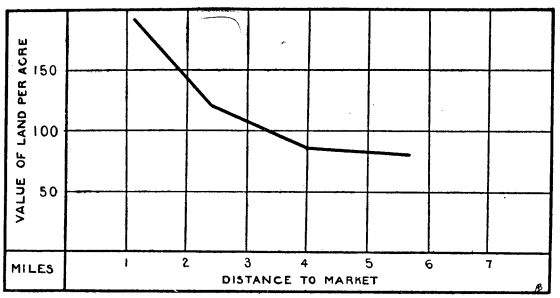

FIG. 11.—Effect of distance to market on the value of muck land per acre.

DRAINAGE.

All muck land is naturally low and wet and therefore must be drained artificially. In the case of large marshes, adequate outlet ditches must be provided. Laterals can be either open ditches or tile, but tile drains are much more convenient, though open ditches are much better than no drain at all. Seventy-five per cent of the farmers interviewed use tile drains, averaging 5 to 12 rods apart, the other 25 per cent depending on more or less incomplete open drainage systems. The smallest tile used for laterals averaged 5 inches, and since there is a tendency for fine particles of muck to sift into the tile at the joints, it does not seen advisable to use 4-inch tile except for very short laterals. Covering the tile with weeds or straw as they are laid will prevent this filling up to some extent.

The fairly rapid settling of new muck land, necessitates the laying of tile drains deeper than usual. If the fall permits, drains should

be placed at a depth of 3½ to 4 feet. If they are placed nearer the surface, uneven settling of the soil will frequently throw the tile out of line, thus ruining the drain, and even if this does not occur it will become rapidly less efficient as the surface settles toward the level of the tile. Numerous muck fields were seen where tile drains which had been laid at a depth of 2½ feet 8 or 10 years before were being uncovered with an ordinary breaking plow.

It is sometimes advisable to dig open ditches, as a temporary measure, to be replaced later by a permanent system of tile drains. Where higher land borders on muck, it is very important to lay a drain

FIG. 12.—Much of the muck land can easily be cleared and put under cultivation.

around the border to catch the seepage from the high lands. If this is not done there will be wet spots just inside the border of the muck.

A definite plan should be worked out and followed in all drainage work. Usually time and money will be saved by securing the services of a competent drainage engineer.

SOIL MANAGEMENT.

The muck soil of northern Indiana and southern Michigan shows a wide range of variations. In some places it is as deep as 10 to 20 feet, the lower layers being composed of peat in various stages of decomposition, while in other places the muck grades off toward the higher surrounding land and is intermixed with a large proportion of sand or clay, resembling black loam, and by some writers characterized by the term "marsh border" soils.

The native vegetation on these soils varies as much as the soils themselves. In some marshes black ash and elm predominate, some support a growth of tamarack, and still others were originally open prairies covered by a heavy growth of marsh grasses and a great variety of mosses, weeds, and shrubs. Occasionally huckleberry and cranberry marshes are found. Still less frequently small areas are covered with dewberry briars. These latter types of vegetation usually grow on soils that are very deficient in lime.

The average depth of the muck on all the farms studied was about 5 feet. When first broken up this soil is usually loose and spongy gradually decomposing upon exposure to the air by drainage and tillage. This results in continued settling, the amount of which will depend upon the original depth of the muck. The farms studied had been farmed for an average of 12 years, and during that time had settled at the rate of about an inch a year.

Muck soils are radically different from other types, owing to the fact that they have been formed almost wholly from the decay of vegetation, while the heavier types have been formed by the processes of rock weathering. Clay, loam, and sandy soils are frequently in need of organic matter and nitrogen, while muck soils are usually lacking in certain mineral constituents, especially potash and phosphates, and occasionally lime. On most muck soils in this region potash is the most important fertilizer ingredient needed, though the application of available phosphates usually produces additional beneficial results.

Farm experience, field experiments, and soil analyses have all clearly demonstrated that, excluding drainage, the question of fertilizing and manuring muck soil is the most important factor in determining crop production on muck land. The fact has further been substantiated by this study.

Many muck soils have produced fairly good crops for a year or two, after which production diminishes rapidly unless fertilizers or manure are applied. Some muck soils are so deficient in potash that they will not produce anything even when first broken up, so that the most experienced muck farmers use fertilizers or manure from the very start without waiting to see if a crop can be produced without reinforcing the meager supply of mineral plant food already in the soil, thereby running the risk of losing a crop.

Nitrogen is present in all muck soils in abundance, but it is probably fortunate that only a small portion of it is available for any one year. On new muck land and for intensive crops it may occasionally be profitable to use fertilizers containing some nitrogen, since the bacteria which render soil nitrogen available are not always present in sufficient numbers in new muck. It often happens that on new muck lands manure is especially valuable since it inoculates

the soil with bacteria, at the same time adding considerable mineral plant food in fairly available forms. But after muck land has been farmed for a few years it is doubtful whether the application of nitrogen-carrying fertilizers is necessary.

Potash alone is usually applied to muck land in the form of commercial muriate of potash. The more expensive sulphate of potash is thought by some to produce better quality in onions, potatoes, and other truck crops, but these claims do not seem to justify the extra expenditure for the higher priced form of potash. On muck soil which has not been previously fertilized or manured, it is customary to apply from 100 to 200 pounds of muriate of potash per acre for extensive, or corn and small grain crops, and from 200 to 400 pounds per acre for truck or intensive crops. This application is repeated every two or three years, or a smaller amount is applied every year. This treatment usually gives excellent results, the yields frequently being increased from 50 to 200 per cent over the yields of similar untreated land. A large amount of ready mixed commercial fertilizer is also used on the muck soil in this region. The potash content of these fertilizers ranges from 8 to 15 per cent and the available phosphate from 5 to 10 per cent. From 150 to 300 pounds per acre are used on extensive, and from 300 to 1,000 pounds or more per acre on intensive crops. The phosphate induces earlier ripening of crops, better quality, and a somewhat higher yield. It is usually more economical to buy potash and acid phosphate separately than to use ready-mixed goods.

At the present time (1916) the supply of commercial potash in this country is so low that very little is available for fertilizer and the price is prohibitive. Every effort should be made to conserve the potash already in the soil. Farm manures and crop residues have a relatively higher value at present than when the fertilizer supply is normal and will give excellent results when applied to muck land. Farm manure contains on the average about one-half of 1 per cent, and fresh straw from one-half to 1 per cent of potash, which is readily soluble in water and available for plant growth. It is, therefore, very important to prevent the undue leaching of manure in order that it may give the best possible results when applied to muck land. Many growers prefer manure to commercial fertilizer for truck crops. For general crops, with present prices for potash (1916), six to eight tons of manure per acre in some instances may be more profitable on muck land than on any other soil type, since without potash some muck soils produce very light crops.

In order to obtain a good seed bed, deep muck should be compacted by means of a roller, the heavier the better. Many muck farmers roll several times with an ordinary roller, sometimes weighted with stones, while on a few of the larger farms extra heavy rollers weighing from 3,000 to 5,000 pounds, and pulled either by a tractor or

by horses, have given excellent results. In the case of spring-planted crops it is claimed that danger from frost is much reduced when the soil has been thus compacted.

CROPPING SYSTEMS.

In the case of muck soils there is little need for growing crops that replenish the supply of nitrogen and organic matter in the soil, hence the growing of legumes is not so essential. Rotation of crops, or rather a change of crops on muck soil is desirable, however, as a means of controlling insect pests and plant diseases, and of securing a proper seasonal distribution of farm labor. Farmers who are specializing on crops like onions, celery, or peppermint do not care to give much attention to their minor crops, and hence usually change crops only when their principal crop is threatened with some insect or plant disease.

Of the general crops grown on muck soil, corn is the most important, though hay and grain are usually profitable. A rotation consisting of corn two years, oats and wheat one year each, and hay two years, is well adapted to this soil and provides a good distribution of labor, especially if a sufficient amount of live stock is kept to furnish some work during the winter months. Some corn, hay, oats, and all of the wheat can be sold, which, together with receipts from live stock, will provide enough diversity to insure a fair degree of stability in the farm income to be derived from farming muck lands.

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